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ABSTRACT

Discussed are findings of a review of 21 research reports concerned with the use of environmental music with mentally retarded persons. It is explained that the literature in two data bases was searched and relevant reports examined. The reports are organized into general findings (seven reports), use of music in contingency management (nine reports), and behavior changes of the retarded as a function of different types of music (five reports). Among conclusions is that the most appropriate musical program for a retarded population has a medium tempo with a bright overall stimulation value which uses an ascending curve of stimulation and maintains a high degree of novelty. (DB)

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Environmental Music for the Retarded: A Literature Review

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Muzak, Inc. sponsored this literature review as part of its continuing research into the psychological and physiological effects of music. In response to requests, Muzak is pleased to make the results available to other professionals concerned about helping retarded individuals.

Environmental Music for the Retarded: A Literature Review

I. INTRODUCTION

This literature survey is directed at identifying research published within approximately the last ten years that has studied the use of environmental music with retarded individuals. It includes searches of two computer databases: those maintained by the ERIC Clearinghouse on Handicapped and Gifted Children and by the Council for Exceptional Children. The computer printouts from these searches retrieved a total of 104 references. However, the computer coding systems do not distinguish environmental music from other applications of music, such as singing or playing instruments. It was necessary to call up the entire music category, then screen the data files to select the references that are relevant. The more promising literature was then reviewed in the original where possible, and several additional sources were identified in the references cited. This search finally yielded the 21 relevant research reports that will be discussed in this literature survey.

II. GENERAL FINDINGS

Before recommending environmental music for retarded individuals, it is important to know whether such people like music, and whether they respond to it as a normal population would.

Wasserman et al. (1970) studied the musical backgrounds of 16 mentally retarded psychotics who were more than 16 years old, by having their families fill out questionnaires. The families reported that most of the patients had no formal musical training, and could not sing, dance, or play an instrument. Nevertheless, the Wasserman test found that all but one patient enjoyed music.

Peters (1970) compared the musical sensitivity of normal and Mongoloid children. Her results showed that both groups responded similarly to music.

Decuir (1975) studied the frequency that 16 institutionalized mentally retarded students (8 to 21 years old) vocalized in response to music played on four instruments. Four familiar songs were played on piano, guitar, pipe organ, and electronic organ. He found the students vocalized most in response to the piano. This may mean that, of the instruments studied, the piano was easiest for them to identify with. However, at least some musicians have maintained that a violin, or even a clarinet, sounds more like a human voice than any of the four instruments used in this experiment. It may be that the piano's sharp attack tends to elicit rhythmic responses.

Zine et al. (1975) played tape recordings of children's songs to seven institutionalized retarded males (6 to 13 years old, with IQ's ranging from 5 to 20). Behavior ratings showed that playing music decreased sitting and object manipulation, and increased rhythmic movements. It is difficult to interpret what these changes mean without knowing more about the musical program, and particularly its tempo and loudness. It would appear that playing music may have increased the children's activity level simply because it constituted a marked increase

in ambient sound level; there is some precedent to suggest such an effect, to be described presently, but activity levels are not a simple function of loudness, or whether music is played. Music may also have allowed the children to function more constructively, if rhythmic movement implies better integrated behavior than merely sitting or manipulating objects. Interestingly, both instrumental children's songs and a mixture of vocal and instrumental songs had essentially the same effects on the children.

Levitt and Kaufman (1965) played tapes of continuous white noise to 32 institutionalized children who were mentally defective. The subjects were observed, and their rates of body rocking were recorded, while they sat in groups of four in an 18 foot by 21 foot minimally furnished room during four experimental sessions. The white noise was played at levels of 51 db. ("ambient"), 70 db. ("low"), 85 db. ("medium"), and 110 db. ("high"). Males with high rocking rates did indeed rock even faster as the noise grew louder, but females in the high-rocking group rocked somewhat less at high noise levels. The authors regard this latter finding as unexpected and "in need of replication." They also note two previous studies of mental defectives where more intense visual stimuli (unspecified) lowered activity levels, and auditory stimuli (a tape of the human voice played at double speed) did not affect activity levels. These conflicting results do not point clearly to any simple generalization, except perhaps that high stimulus intensities may increase activity levels. On the other hand, it is difficult to account for how a decidedly unpleasant 110 db. of white noise could reduce activity levels for some subjects while increasing them for others. It is conceivable that diagnoses differed and were associated with sex, or that more subjects would be needed to balance out individual differences.

Two reports suggest that music facilitates attention for children with moderate mental retardation. The Council for Exceptional Children's 1972 convention papers included one article which concluded that both music and social reinforcement increase group attending behavior (as reported in abstract; I have not been able to obtain the paper itself).

Stainback et al. (1973) studied how music affected the learning of both relevant and irrelevant material. They used two sets of subjects -- 32 primary (120-149 months), and 32 intermediate (150-173 months) -- for a total of 64 subjects, described as "educable mentally handicapped institutionalized children." There were two sound conditions: ordinary incidental sounds from the hall, and "calming" music (Bach's "Air for the G String"). The children were given an opportunity to learn both relevant and irrelevant material under both sound conditions. The results showed that primary and intermediate children did not differ from each other significantly in learning either type of material. Nor did the music and no-music groups differ in learning irrelevant material. However, the music group learned significantly more relevant material. The authors concluded that "Music may be an aid in enabling students to attend to relevant stimuli. . . . It appears that music enables institutionalized educable retarded children to process more information, since relevant learning was increased without reducing irrelevant learning."

Together, these two studies seem to indicate that, at least for moderately retarded children, music helps them focus their attention.

In summary, these rather fragmentary general findings do not provide complete data about all possible kinds of retarded individuals. However, the available data indicate that the majority of the retarded enjoy music and have similar musical sensitivity to normal children. They vocalize most with piano music. Playing music has been reported to increase rhythmic movements and, in some cases, to increase activity levels, although there is reason to question the generality of the latter finding. Two of the reports suggest that music facilitates attention for children with moderate mental retardation.

III. CONTINGENT MUSIC

Nearly half of the relevant research about music for retarded persons -- 10 of the 21 citations -- deals with what is called contingent music, where the music is given as an incentive or reward for certain behavior the experimenter wishes to encourage. If the music can then function as a true reward, or reinforcer, the subjects should learn to make the responses that cause it to be played. Obviously, music is not a primary physiological reward in the same sense that food is; a person who is hungry will still be hungry until he gets food, regardless of whether or not he hears music. On the other hand, it is well accepted that reinforcers need not replenish a physiological lack to be true rewards; the sweet taste of saccharin can be rewarding, although it serves no nutritional function, and even birds and insects have been reported to prefer certain colors over others. Thus it is quite plausible that a pleasant experience, such as hearing music, could motivate behavior and serve as the basis for learning.

Saperston (1973) described how musical feedback was used to "establish communication" with a profoundly retarded, autistic 8-year-old boy. "The therapist matched certain music patterns to the boy's activity (walking, stomping, rocking, shuffle steps, and hand pounding). At the 20th session the boy showed evidence of understanding that his activities were controlling the music. . . ." Eventually, he showed "increased awareness, eye contact, and vocalizations."

Jorgenson (1971) used contingent preferred music to reduce hand movements and rocking in a profoundly retarded 10-year-old girl who had been diagnosed as having the genetic defect phenylketonuria. While she made the desired responses, she received verbal stimuli and heard the music she preferred. But when she made stereotyped movements, the music was interrupted until she stopped them. This treatment appeared to be effective in controlling her stereotyped movements.

These two studies are typical of the literature about music therapy, since they involve long and intensive work that is carefully tailored to an individual. While music is undoubtedly one of the important variables, it seems clear that other equally important but less tangible variables are also operative, such as the therapist's personality. While such studies illustrate how music can serve as a contingent reinforcement, it is rather difficult to generalize the results to other people or groups of people.

Cotter and Spradlin (1971) applied both noncontingent and contingent music techniques to 38 retarded children between 8 and 18 years old, whose IQ's ranged from 35 to 89. After first experimentally determining the music a separate group of 66 retarded children preferred, Cotter and Spradlin began by giving alternate five-minute segments of preferred music and silence while the 38 subjects worked on addition problems. This was noncontingent music, since the children heard it continuously regardless of what they did. The investigators found that 27 of the 38 subjects performed better during silence. This result may well have occurred because the preferred music, by its very nature, attracted the subjects' attention and distracted them from the addition problems. In a following phase of the experiment, sounds became contingent: subjects answered the problems by pressing keys and, when their answers were correct, various groups of subjects heard music, or white noise, or silence. All of the sounds (except silence) gave a subject cues about whether his response was correct, but, as one would predict, the music evidently had greater reward value than white noise or silence. It would appear that the imminent threat of punishment (by turning the music off) overcame the tendency of preferred music to distract.

In another experiment, Cotter (1971) tested 16 moderately retarded girls on a simulated workshop task, measured each girl's performance, and formed the girls into pairs with comparable ability. Then he tested one girl of each pair with contingent music, and the other with noncontingent music. He called this procedure "yoking" -- both girls in a pair heard the same music through headphones, and it depended on the work performance of one girl (contingent music), but had nothing to do with the work performance of the other girl (noncontingent music). (This procedure was closely similar to Brady's famous study of the "executive monkey," who could make a response to prevent shock, while his yoked partner had no control over the shock.) Cotter's test sessions lasted an hour and a quarter, with alternate 15-minute periods of music and silence. The results showed that contingent music produced significantly higher work rates than silence or noncontingent music. These findings appear consistent with some of the results discussed previously. As before, music that is given as a reward, and keyed directly to the subject's performance, can improve performance. However, noncontingent music which is programmed in some unknown way does not necessarily improve performance. In actual fact, since the music used here would come and go unpredictably and with no obvious reason for the noncontingent member of the pair, it would appear to be particularly distracting, and should degrade performance; it seems remarkable that the noncontingent music did not produce even poorer performance than silence.

There seems to have been considerable interest in how music affects imitative behavior. One gathers that an important method for teaching retarded children is enticing them to imitate the teacher's behavior. Thus imitative behavior is desirable, and any procedure that can facilitate it is useful.

We have already considered Saperston's case study of an autistic 8-year-old boy, and how musical patterns were matched to his activities. While it is difficult to generalize from a single case, Saperston appears to have established a link between behaviors and the accompanying music, so that one could call forth the other. Yet in this case it is difficult to decide whether the autistic boy, or the piano player, or both, are being imitative.

Underhill and Harris (1974) tested four moderately mentally handicapped children between the ages of 9 and 13. They asked these subjects to do ten imitative tasks with contingent music, with noncontingent music, and in silence. When hearing music was contingent on a correct imitative response, all of the subjects made substantially more imitative responses on all ten tasks. However, mere ambient music (noncontingent) did not increase imitative responses. The results with contingent music confirm music's award value by showing that it changed the subject's responses. But the findings with noncontingent music indicate that music per se neither increased nor decreased imitative behavior.

Dorow (1975) used music as a "learned reward" with three multiply handicapped, severely retarded girls between the ages of 9 and 15 years. By giving verbal approval and/or music together with food, she caused part of the food's primary-reward characteristics to become associated with approval and music. The secondary incentives of music and approval were then used as rewards for imitative behavior. Not surprisingly, Dorow found that these secondary incentives did increase imitative behavior. Also, they did not lose their reward value when food was no longer given. While there is little question that music and approval did increase imitative behavior, it does not seem conclusive that this happened because of their secondary reward value from association with food. The other research with contingent music clearly shows that music can function as a reward in its own right -- has an inherent reward value -- quite apart from whether or not it has been associated with food.

Intuitively, and from other research not cited here, I feel the same is true of approval; beyond the very early ages, certainly, approval is intrinsically rewarding. This may explain why music and approval continued to be rewarding even when they were no longer paired with food. I interpret Dorow's findings as verifying that music is a genuine reward and, as such, can affect learning and behavior.

Metzler (1974) attempted to increase imitative behavior by playing music to 30 severely mentally retarded females between the ages of 16 and 55. She divided her subjects into three groups, which heard either (1) no music, or (2) contingent music for more sorting responses or more accurate sorting responses, or (3) continuous, noncontingent music. Imitative and discriminatory behavior did not change significantly in any way that could be attributed to music. This negative finding runs counter to the rest of the literature surveyed. It is always difficult to interpret results which fail to detect differences between conditions. Such negative results may mean there really is no difference, or they may merely mean that the experiment was unable to detect real differences, perhaps simply because not enough subjects were tested. It seems noteworthy that Metzler tested more adult and older-adult subjects than the other investigators did; these older individuals have likely been institutionalized for much of their lives, and their behavior patterns may have become firmly consolidated. Psychologists generally agree that it is more difficult to change behavior in older people, if only because more years of learning have produced strong habits that are difficult to modify. It is also possible that Metzler's three groups were not matched adequately.

Miller (1977) provides an interesting sidelight on contingent music. In brief, she tested 30 mentally retarded but educable children between 9 and 14 years old, doing arithmetic problems. In control conditions, the children completed their arithmetic session and simply returned to their classrooms. But in the two experimental treatments, children who performed well enough could stay and listen to either highly preferred music (rock) or low-preference music (classics). The students performed significantly better in both of these two experimental conditions. However, they performed as well when rewarded with low-preference classics as when rewarded with the high-preference rock; both were equally effective. And the experiment did not affect their music preferences. At the end of the study, the students did not like rock any less, or classics any more. One speculates that other rewards besides music may also have been involved -- there may have been some "Hawthorne effect" -- but Miller's findings suggest that it is possible to use music effectively as a reward even if one cannot give each individual his own favorite music. There seems to be considerable leeway in selecting music without compromising its reward value.

Bellamy and Sontag (1973) tested the effects of music that was contingent on a group's performance, rather than an individual's. There were two groups of trainable mentally retarded students, one 11-12 years old, and another 13-20 years old. The subjects worked on an assembly-line production task under two experimental conditions: (1) music was played only when the team stuffed and boxed an envelope within a time limit; and (2) music was played continuously, but played louder when the team stuffed and boxed an envelope within the time limit. As the preceding studies would lead us to expect, both kinds of contingent music increased the production level. The investigators concluded that music "was an inexpensive and effective means of increasing production among retarded workers."

In summary, there has been considerable research interest in contingent music, and this area accounts for nearly half of the relevant literature in the present survey. The weight of research findings indicates that music can be used as an effective reward with various kinds of retarded individuals. It has been repeatedly demonstrated that, when music is used to reward desired behavior, it can serve as the basis for modifying learning and performance. Furthermore, even low-preference music appears to function as an effective reward.

The classical use of contingent music is playing music to an individual when he makes the desired individual responses. This individual procedure can be very labor-intensive for the staff, and it is probably only practical in limited situations and for comparatively short times. Yet there is also precedent for playing contingent music to groups, and for larger and more complex activities over longer periods of time. These group applications are obviously more feasible to use in an institution. Even if group procedures should have lower effectiveness per unit time, the fact that they can be used with many more individuals over much longer times may well give them greater effectiveness over the long run.

The most obvious application of contingent music is turning a ward's music on when the patients show desirable behavior, and turning it off when undesirable incidents occur. This arrangement would not only reinforce desirable behavior directly, but it should provide social reinforcement as well.

Another possibility is allowing patients to stay in a "reward area" with music as long as their behavior is acceptable, but requiring them to go to a no-music area when they show undesirable behavior. Thus access to an area with music becomes a reward for desired behaviors. If the staff wishes to encourage patients to spend more time in certain areas (e.g., occupational therapy) rather than others (e.g., residential areas), music could be provided differentially in the former, but not in the latter.

There seem to be a wide range of ways to use music as a reward to encourage a variety of desired behaviors. These possibilities deserve careful consideration and exploitation.

IV. MUSIC VS. MUSIC:

COMPARING DIFFERENT TYPES OF MUSIC

Five of the studies attempted, in one way or another, and for longer or shorter periods of time, to determine how retarded people's behavior is affected by varying sorts of music. Studies in this area can offer important clues to the kind of music that will prove most effective for retarded people.

Richman (1976) worked with 20 severely retarded, institutionalized males, 16 to 18 years old. These subjects were asked to perform a repetitive manual task selected as similar to the sort of task done in sheltered workshops. Each subject was tested with four ambient sounds: music with slow tempo, music with medium tempo, music with fast tempo, and no music. We should emphasize that, unlike the preceding group of experiments, all of Richman's ambient sounds were noncontingent -- the subject was exposed to a sound condition continuously throughout an entire experimental period, regardless of what responses he might make. Obviously, these conditions represent the ways Muzak is actually used more closely than contingent music would. Richman found that "the regular tempo of background music facilitated the greatest improvement in performance, suggesting that the effect of music on performance is more complex than the issue of contingent presentation." The contingent-music experiments have succeeded in showing that music can be used as a reward to modify behavior, but they have not demonstrated that noncontingent music has any important effects on behavior of the retarded. Richman's experiment extends this principle to show that purely ambient (noncontingent) music can also improve performance. With the manual performance task Richman used, it seems quite possible that the medium-tempo music

acted as a pacing stimulus to increase the work rate. Fast-tempo music may have been less effective because it was simply too fast for the task. Slow-tempo music might act to reduce the rate of work, thus degrading performance. This line of thinking suggests that the most useful music would be moderately bright in tempo, but not lugubriously slow or frantically fast.

Stevens (1971) also varied musical tempos to see how they would affect the rate at which subjects rocked. Here "rocking" means a stereotyped, mechanical body-movement pattern that occurs at a regular, persistent, rhythmic rate. "Recent literature," the author notes, "reflects a concern for environmental modification of stereotyped movements." Stevens selected 12 male and female subjects, aged 13 to 21, who had shown a high probability of rocking. After determining each subject's personal rocking rate, she observed him while he heard marches played on a piano at the same tempo as his baseline rocking, at 16 beats per minute faster tempo, and at 16 beats per minute slower tempo. The music used was described as "having a strong rhythmical beat," such as "Onward Christian Soldiers." Its loudness ranged from 60 to 76 db on the B scale of a sound-level meter. Stevens' results verified that "environmental manipulation of musical tempo can produce significant changes in speeds of body rocking." The exact sort of changes, however, depended on how fast an individual rocked to begin with. People with slow baseline rocking rates rocked less when the tempo was increased. On the other hand, people with fast baseline rocking rates rocked less when the tempo was decreased. Since fast and slow rockers respond in opposite ways, rocking behavior can be reduced for both by playing medium-tempo music.

Rieber (1965) observed intellectually average 5- and 6-year-old children in a special playroom to see how fast, exciting music and slow, soothing music affected their exploratory and manipulative behavior. The playroom contained various sorts of toys which could be made to operate by turning cranks, pushing levers, and the like. For example, there was a toy train in a plexiglas cage; turning a crank made it run around the track, and the faster the child turned the crank, the faster the train went. Each of the 29 children spent 12 minutes in the playroom: three minutes in silence, three minutes with "soothing" music, three more minutes of silence, and three minutes with "exciting" music. The "slow, soothing" music was part of Bach's "Air for the G String." The "fast, exciting" music was from Offenbach's "Gaite Parisienne."

Rieber reported that the rates of response were significantly higher during both periods with music, and highest with the fast, exciting music. The rate of response shows a smooth, almost ruler-straight increase over the four periods when soothing music was given second and exciting music was given fourth. But this even, linear progression was disrupted when exciting music was given second, and soothing music fourth. These results suggest that an ascending curve of stimulation is more appropriate than a descending curve.

The children's variability -- changing from one toy to another -- decreased as they spent more time in the room. Rieber states that this increasing concentration on a single toy is "unaffected by music," but I must disagree. Silence was always given in the first and third periods, and music in the second and fourth periods. Thus silence always occurred systematically earlier in the test period, and music systematically later. This means that Rieber's experimental

design confounded the time and music variables, and their effects cannot be separated. It appears quite likely that music was at least partly responsible for the children's settling down to concentration on one toy, rather than skipping from one to the next. Rieber's study, then, seems to indicate that music helped the children adjust to an initially strange situation and facilitated their concentrating on constructive play with a single toy. While these subjects were of average intelligence, it seems quite reasonable to expect that retarded children would behave similarly.

Scott (1970) studied four hyperactive institutionalized boys, ranging from 7 to 11 years old, "who had a well-deserved reputation as a disruptive influence in school." He speculated that, although hyperactivity can be controlled by reducing the stimulating characteristics of the child's environment, "background music seemed to have a calming effect on the behavior of hyperactive children." Scott had the boys work arithmetic problems under four conditions: (1) sitting at desks in an open area like a normal classroom; (2) as in condition 1, but with background music; (3) sitting in a three-sided booth designed to exclude extraneous stimuli; and (4) as in condition 3, but with background music. The music used in conditions 2 and 4 was two Beatles albums, "Sergeant Pepper's Lonely Hearts Club Band" and "Magical Mystery Tour."

The results showed that "Three of the four children functioned at their best under regular classroom conditions with music playing. . . . The results of the present study confirm the observation that the productivity of hyperactive children in an academic setting may be enhanced by the introduction of background music." Thus Scott demonstrated that comparatively stimulating environmental music can, paradoxically enough, reduce hyperactivity -- but Scott did not present any thoroughgoing explanation of why this might be so.

Two months later, Reardon and Bell (1970) published what proved to be easily the most thoughtful and theoretically oriented discussion of how environmental music affects activity levels. The literature, they observed, provides a basis for three competing and mutually exclusive theories.

First, that hyperactive behavior aims to compensate for a lack of stimulation. Bright music provides just the sort of stimulation the hyperactive person is seeking, so it reduces his need to be hyperactive. The brighter the music, the less the hyperactivity. This, in actual fact, was precisely the result that Scott had found.

Second, that auditory stimulation is essentially a motivational factor; it increases the total amount of drive. Therefore, music should increase the person's activity level, and bright music should increase activity more than quiet music.

Third, that music can either increase or decrease activity, as the early music therapy practitioners maintained. Relative to the baseline activity level in silence, "sedative music should reduce activity while stimulative music should increase it."

Reardon and Bell set out to devise a critical experiment that could show which of the theories was correct. They selected 11 subjects who were severely retarded, institutionalized boys between ages 6 and 17, with IQ scores ranging from 9 to 55. Trained observers rated each subject in 14 behavioral categories 11 times per hour, for a total of eight hours of observation under each of four conditions:

(1) No recording -- a control condition to measure baseline activity levels.

(2) Spoken recording -- a tape recording of a male voice reading "Pinnocchio."

(3) Sedative music -- "orchestral versions of Bach chorales. Slow tempos and broad harmonics in the lower registers were characteristic."

(4) Stimulative music -- "rock and roll, featuring electric guitars and drums. The tempo was fast, and the driving rhythm overshadowed the harmonic and melodic aspects."

While the results were not entirely clear cut, "Differences in activity due to conditions tended to confirm the prediction of lower activity levels during the more stimulating conditions. . . . The total pattern of results agreed most closely with the first hypothesis presented above, which views stereotyped behavior as providing stimulation to children who are stimulus deprived through either physiological or environmental conditions. The derived prediction that auditory stimulation would decrease activity levels was supported by three aspects of the results. . . . The one differential effect due to type of music indicated lower activity level during stimulative than during sedative music." The authors concluded that "playing stimulative music on the wards of overactive retarded children may be helpful in modulating activity levels, if novelty is assured." Novelty, they indicated, is important in maintaining a sound's stimulating effect, and hence its potential for reducing hyperactivity.

In summary, these experiments demonstrate that noncontingent music can improve the work performance of retarded people; medium tempos were most effective with the types of tasks studied. A study with intellectually average children indicated that musical stimuli promoted adaptation to a novel situation and constructive concentration on one toy, particularly when the music series ascended in stimulation values. Two experiments, by Scott and by Reardon and Bell, agree that music tends to reduce hyperactivity, and that stimulating music reduces it more than quiet music does. Reardon and Bell's findings suggest that stimulus novelty is also an important factor in reducing hyperactivity.

Altogether, these research results indicate that the most appropriate musical program for a retarded population would be a medium tempo of music, with a rather bright overall stimulation value achieved by manipulating other musical variables. The program segments should use an ascending curve of stimulation. To maintain a high degree of novelty, no musical program should be played repeatedly; if possible, each program in the experimental series should be different from all the others.

SUMMARY AND CONCLUSIONS

This literature survey is directed at identifying research published within approximately the last ten years that has studied the use of environmental music with retarded individuals. Searches of two computer databases yielded the 21 relevant research reports discussed in this review.

Seven research reports presented general results about how retarded individuals experience music, although these rather fragmentary general findings do not provide complete data for all possible kinds of retarded individuals. However, the available data indicate that the majority of the retarded enjoy music and have similar musical sensitivity to normal children. They vocalize most with piano music. Playing music has been reported to increase rhythmic movements and, in some cases, to increase activity levels, although there is reason to question the generality of the latter finding. Two of the reports suggest that music facilitates attention for children with moderate mental retardation.

Nearly half of the relevant research about music for retarded persons deals with what is called contingent music, where the music is given as an incentive or reward for certain behavior the experimenter wishes to encourage. The weight of research findings indicates that music can be used as an effective reward with various kinds of retarded individuals. It has been repeatedly demonstrated that, when music is used to reward desired behavior, it can serve as the basis for modifying learning and performance. Furthermore, even low-preference music appears to function as an effective reward.

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There seem to be a wide range of ways to use music as a reward to encourage a variety of desired behaviors. These possibilities deserve careful consideration and exploitation.

Five of the studies attempted to determine how retarded people's behavior is affected by different types of music. These experiments demonstrate that noncontingent music can improve the work performance of retarded people; medium tempos were most effective with the types of tasks studied. A study with intellectually average children indicated that musical stimuli promoted adaptation to a novel situation and constructive concentration on one toy, particularly when the music series ascended in stimulation values. Two experiments, by Scott and by Reardon and Bell, agree that music tends to reduce hyperactivity, and that stimulating music reduces it more than quiet music does. Reardon and Bell's findings suggest that stimulus novelty is also an important factor in reducing hyperactivity.

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